Developing a Proxy Model for Solar EUV Irradiance

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Space weather can have major impacts on communication, aviation, power grids, GPS accuracy, and satellite drag. It is therefore important to be able to accurately predict the occurrence and effects of space weather. Solar EUV radiation is an important energy input to the ionosphere-thermosphere (I/T) system and is an important driver for the models that aid these predictions. Since EUV irradiance is difficult to measure and sensors degrade over time, modelers often rely on ground-based proxies that fail to accurately capture short-term variability and long-term trends in solar EUV irradiance.

In this work, we aim to use the three solar EUV bands and two X-ray bands from the NOAA GOES satellite along with two proxies, F10.7 index and the magnesium core-to-wing ratio, to create the full solar EUV spectrum from 0 to 105 nm at 5 nm resolution. We employed a least squares fitting routine based on the Levenberg-Marquardt algorithm to fit the GOES, F10, and Mg II data to the observed EUV spectra from the SDO EVE and TIMED SEE instruments. We developed fitting coefficients using data from 2012 then applied them to 2011 and 2013 data to determine how well the model performed. We found this proxy was able to predict EUV fluxes from 5-40nm with a linear Pearson correlation of 0.975 or better; it was much less accurate at longer wavelengths, with correlations ranging from 0.3-0.8. We suggest possible explanations for this wavelength-dependent accuracy as well as directions for further research. Overall, using EUV broadband data to model the full EUV spectrum proved to be effective at predicting both trends associated with the recent solar cycle as well as small-scale variations at wavelengths below 55 nm.